Leading the way for energy conservation and net zero energy design, Lady Bird Johnson Middle School is playing a vital role in the transformation across Texas, and across the country, regarding how school buildings are designed and used. Irving Independent School District’s eighth middle school is a 152,000 square foot facility designed to relieve overcrowding at the district’s other seven schools. District Administrators saw the opportunity with this new facility to develop a sustainable environment and set the goal for the project to be a net zero energy building. The design team responded to the district’s goal of net zero energy with a day-lit, wireless environment that supports the energy conservation through geothermal, LED lighting, lighting controls and monitoring systems, while providing wind and solar power that provide the energy for the building operation and are integrated into the school science curriculum. Lady Bird Johnson Middle School is a living, learning, sustainable laboratory that prepares students for environmental responsibility and stewardship in a flexible learning environment.
Scope
The first net zero building in the State of Texas, Lady Bird Johnson Middle School is located in the heart of Irving, Texas and serves, educates, and inspires the surrounding community. The two story academic building is designed to house over 900 sixth through eighth grade students. The 152,000 square foot structure includes classroom, labs, library and lecture areas, kitchen and dining facilities, fine arts spaces for performing and visual arts, and athletic spaces including two gymnasiums. The school’s gymnasiums, cafeteria and library spaces are designed for community use after hours. Lady Bird Johnson Middle School has been submitted for LEED recognition and is currently in the final review stage by the U.S. Green Building Council for Gold certification.
2.0 PLANNING PROCESS

Project Challenges
Any project of this magnitude and scope will present a multitude of challenges to the designer, builder, and owner. For the purposes of this submittal, we will address those challenges relating to the project goals, and budget, site constraints, and schedule.

Budget:
The middle school was first conceived and included in a bond program years before the actual project was set to proceed. As a result, the goals for a sustainable net zero energy school were not considered in the budget.

The wealth of innovations relative to sustainability, energy conservation, and energy production resulted in a building that was more expensive than a typical middle school project. This fact was known early in the design phase, and communicated to the Board of Trustees and the community prior to moving forward with the design. In total, the project cost increased 12-15% due to the sustainable features, conservation measures, and systems inherent to the educational intent for students. In dollars, this was approximately $4 million.

During such challenging economic times, it would seem difficult to request an additional $4 million. However, due to the long-term benefits for the environment, economy, and students, the Board of Trustees did not hesitate. Communication was the key to dealing with the significant budget concerns.

Site Constraints:
The location and shape of the 17 acre site brought additional challenges. Surrounded by high density residential on two sides and the back of commercial retail on the other two, the already narrow site was narrowed further by a large drainage channel and the 100 year flood plain that came with it cutting off portions along the western side of the site. The site narrows even more on the southern side, which unfortunately, was the main road access and considered to be the front of the school. One alternative involved placing the football field / athletic area in front of the school to accommodate the preferred east-west axis orientation, but it was decided such positioning would send the wrong message to the community, and possibly result in diminishing the true objective of the building. The need to have the front of the school on the narrow southern portion of the site forced the compact building footprint into a north–south axis orientation.

The design team responded to the orientation challenges through the incorporation of passive solar techniques. Sun angle and shading models were studied to identify the optimum shading for the west facing windows. Ultimately, the solution involved a large shading structure for the second floor windows and “stepping” the building along the western side so the second floor shaded the first floor windows through the end of the school day. Clerestory windows provide natural light to interior corridors and central spaces of the compact building footprint.

Project Schedule:
In November 2009, the Irving ISD board of trustees approved moving forward with the district’s eighth middle school to alleviate overcrowding and allow each middle school the goal population of 900 students. At the time, three of the district’s seven middle schools had over 1,200 students, with the remaining schools at or just above capacity. To alleviate the overburdened schools and accommodate the district’s steady growth, administrators set the goal of an August 2011 opening for the school, and the building design goal of net zero energy. The documents for bidding were issued in March 2010, with bidding commencing in April to allow time for construction. This resulted in a five month schedule to design and document a 150,000 square foot net zero energy school.

With a typical school, the compressed schedule would have been a challenge, but Lady Bird Johnson Middle School is anything but typical. The investigation of sustainable strategies and cost analysis studies could only be accomplished within the schedule parameters by involving all parties in an open flow of information and decision-making that would provide the best solutions for the building, the net zero energy goals, and the educational environment. This collaborative approach continued through the development of the design, detailing of systems, and construction. The school was ready for students in August 2011.
Planning Process

Site Plan
Planning Process

Project Stakeholders
A project of this type has many stakeholders that not only participated in ways that went beyond the design and construction process to ensure “buy in” of the structure type for years to come. Some of the critical stakeholders for this project are listed below.

Students:
Students are our most valuable stakeholder and a large reason Lady Bird Johnson Middle School was designed to be a sustainable learning laboratory. The decision to move forward with a net zero energy building was made because it was the right thing to do for current and future students in Irving. Every child who attends Lady Bird Johnson Middle School is taught how the sustainable systems work and learns about the benefits to the environment. Students become stewards of the environment and are empowered to make the right choices that will affect their environment in a positive way. This sense of ownership is evident in the student ambassadors who lead visitors on tours of the facility and its sustainable systems.

District Staff:
This project is a testimony to collaboration. Not only were district staff needed to optimize the design, but because of the building type, district staff wrote curriculum based on the technologies and sustainability features inherent in the building. Typically, a building is constructed that allows for the normal, routine curriculum of the district to be implemented. In this scenario, everything started with the initial design process, including the method by which students would be educated, which ultimately evolved into a project based learning platform.

City Staff:
City staff played a vital role in the design and construction of this building. Since it was considered the first of its kind, a great deal of collaboration took place with city officials in order to educate them about the intent of the building. Many components, such as the wind turbines, had never been utilized within the city limits, therefore no local codes or ordinances were in place for the acceptance of these systems. Even though the city worked with the team to resolve these issues, it resulted in city officials revisiting the local building code to ensure consistency and compliance on any other similar projects in the future. Needless to say, city staff was an integral component to the success of this project.

Community:
Other than the students, the community was perhaps the most important stakeholder. Since the entire school district is within the City of Irving, it is, in effect, a microcosm of the city. What the district does reflects on the city, just as city decisions reflect on the school district. Knowing that, a number of meetings were held and presentations given to various civic organizations to describe the type of building that would be constructed, and the additional costs associated with it. Because of this important relationship, it was critical that the community support the concept.

Governmental Agencies:
A building of this type has a direct impact on utility budgets; that is, less dollars being spent for the consumption of electricity, natural gas, and water. While the savings was a huge benefit to the district, as the largest client of these services for the City of Irving, the end result was a significant reduction in revenues for the City, as well as other utility providers. In reality, by significantly reducing utility consumption and costs, the providers benefitted by needing less equipment for demand. In the end, all the utility providers were amenable to the building type and now use the building as a prototype for consideration by other interested clients.

Environment:
Without a doubt, one of the stakeholders that benefits the most from the design of the Lady Bird Johnson net zero energy middle school is the environment. The sun and wind are utilized to create and provide electricity. Water is recycled and used for irrigation of landscaping. Many sustainable products are contained within the building that substantially benefit the environment. All these systems and products significantly reduce greenhouse gas emissions and our carbon footprint.
Planning Process

Community Engagement
Communication: As with any project, communication is the key to success. This was even more critical on a project of this type. As mentioned, controversial technologies were used that were expensive and somewhat unproven. If unsuccessful, a negative perception of the district as a whole would result. With that in mind, communication to district staff and the community was of paramount importance. Prior to the start of construction, the project team was fully aware of the district’s expectations of this building and how it would serve as a landmark for both the district and the city.

Positive Feedback: Feedback from the Irving community has been positive regarding the net zero school and its use of our natural resources for generating electricity and conserving water.

Community Benefits
A net zero project brings a multitude of benefits to the community. What might have been a “difficult sell” to the community due to added expense, was actually greeted with excitement and eagerness. More specific benefits include:

Prototype:
Typically, every imaginable building type has previously been constructed. In this case, the school was the first of its kind. For that reason, there was not a lot of research about how to construct a building of this type. There was data in regard to the system types, but none in terms of integrating all the system types into one facility. The resultant product can now serve as a prototype for future facilities in terms of the highest level of energy conservation and renewable technology integration.

Environment Friendly:
In terms of the environment, the building is a model of energy conservation, renewable energy, and sustainability. Products such as rubber flooring, high efficiency lighting and low VOC paint contribute to a building that is representative of the highest regard for sustainability and provides a healthy learning environment for the students and faculty.
Planning Process

City Collaboration:
The city of Irving has one of the most aggressive “green” campaigns on record. When word of this building was shared with city officials, they were excited about its compatibility with the city’s plan. Lady Bird Johnson Middle School has been recognized as the “building of the year” by the city, and has won many other city awards for its design. The school has inspired city leaders to look to new municipal buildings with net zero goals.

Everybody Learns:
A building of this type should not be limited to the education of children, but be used to educate the community. While students are our future, a commitment to sustainability must also be recognized by today’s generation. Only then can we provide a model, sustainable environment for future generations.
Planning Process

City Showplace:
The unique qualities of this building, the wealth of innovations relative to sustainability and energy conservation make it a showplace for the district and the community as a whole. The school has contributed to a more collaborative effort amongst city and school district officials, and is featured in the city’s marketing campaign.
Learning and Teaching Styles
Lady Bird Johnson Middle School provides a flexible learning environment that supports a variety of teaching and learning styles. No matter the style of the instructor, the classroom provides space for direct teaching, small group instruction, and individualized re-teaching. Two generous sized white boards and four accompanying bulletin boards line the interior walls, and allow for split instruction. The uniformity and simplicity of the classroom keeps the space from becoming needlessly cluttered and helps teachers keep the learning objective in focus. The students can be easily grouped by interest or learning style, which makes re-teaching and re-assessing skills effortless.

The flexible environment of a school is important for teaching and learning alike. At Lady Bird Johnson, staff and students feel fortunate to be in an environment that mutually sustains both. Project Based Learning creates a researched based environment that empowers teachers to design engaging and motivating learning experiences for students of their learning style or ability. The projects provide opportunities for the learners to collaborate and bring their individual strengths to the development of the project. Learners build deeper understanding of content and critical, conceptual thinking as they inquire, investigate, problem-solve and create solutions for authentic experiences. This environment increases motivation and success of all students and in most instances, participation in a project team improves the social and academic confidence of students at any level. Project Based Learning also offers opportunities for growth and collaboration for the educator. In the design process, teachers work in partnership to create the learning experience while in the classroom they use their expertise in content and craft to facilitate the pacing, resources, and support for each group on an individual basis.
**Educational Environment**

**Flexible Environment:**

Flexibility is the number one response for science and staff development personnel based on the nature of the instructional implementation. The instructional space as instrumental in bringing about differentiation for the various concepts and groups of children. Thus, technology, multi-purpose space and the furniture within those spaces are important considerations in the net zero campus classrooms.

The core of the campus is the Omni Room. Situated just inside the main entrance of the building, the Omni Room serves as the largest flexible “classroom” setting. Its purpose is to fulfill the needs of the school, district and community. There are two large projection areas; one powered by a large presentation projector and the other by an interactive projector, both of which can be combined. The room also features wireless microphones and adjustable lighting. The large windows from the main corridor allow for visibility from the hallway or library. This room was designed to be instrumental as the staging and debriefing classroom for district field trips. The field trip participants have access to a classroom set of i-pads and/or Net Book laptop computers. The Omni Room is ideal as a science classroom as it has a wet area, large closets along one wall for storage and work space with additional storage. Built-in units house books or bags for class size gatherings. The 17 tables and accompanying chairs are all on wheels and can be arranged as needed.

Students receive instruction related to the four museum structured display nodes that are located in the hallway, the water collection area, and the solar array. Thus, the campus facility can reasonably be viewed as one large flexible classroom with the Omni Room as its central nervous system.

The library at Lady Bird Johnson is arranged as a flexible space to accommodate learners in different situations. The shelving and chairs are on wheels for easy movement. The library has been arranged so there are small work areas for groups of students to come in and work on projects as needed. The workspaces are user friendly and comfortable, with wireless technology throughout and additional handheld devices available for check out and use in the library. Students access the library on a regular basis for research, collaboration recording videos and creating presentations.
Educational Environment

**Wireless Technology:**
Lady Bird Johnson Middle School students and teachers have access to wireless and hand held technology that supports collaborative learning. The commitment to use laptop computers and a wireless network not only helped reduce the building plug load by 50%, students are able to access information at any time throughout the facility. Spaces that housed large banks of computers are now transformed into flexible learning stations within the classrooms. Students have access to a variety of devices and can choose which technology best fits their particular need on a project-by-project basis. Students utilize teaching platform applications, which allows them to share information with teammates and fosters collaborative learning opportunities.

**Curriculum Integration:**
Students at Lady Bird Johnson Middle School have a unique opportunity to experience Science in action throughout the building. Every student who walks through the doors of Lady Bird Johnson sees conservation and smart energy choices at work. An observation deck allows students to see rooftop solar panels installed on reflective roof membrane in order to harvest as much solar power as possible. Downstairs they can see where energy is converted from DC to AC for use in the power grid. Experiencing this first hand is a more memorable experience than a student could ever get from a textbook.

In addition to using solar, wind, and geothermal power, students are taught to conserve and recycle. The building uses as much natural light as possible with lots of windows and reflective lighting. Light sensors turn light sections off when there is no one in the area. Sinks and toilets are automatic to increase specifically and reduce waste water. Located throughout the school are areas set up especially for recycling paper, cans, and plastic. One room is dedicated as a recycling center. One of the most powerful tools used to teach conservation is the pulper. Lady Bird Johnson Middle School has a pulper in the cafeteria where students learn what can be broken down and reused for another purpose through the high pressure water pulper tank, reducing the cafeteria waste significantly over a standard middle school.
Lastly, and probably the most visually stimulating pieces are the museum exhibits. Four hands-on museum quality exhibits in the main hall focus on the four main types of energy conservation at work in the building. The Earth node contains lighted diagrams of the school’s geothermal wells. A three dimensional cut out model of the Earth demonstrates how the geothermal energy works. The wind node contains a model of the inside of the wind turbine and a section where students can turn a turbine and produce energy that lights up the city. The sun node shows how tubular solar panels collect the maximum amount of the sun’s rays. Lastly, the water node illustrates how the school’s design allows for water collection and filters it to be reused. A diagram of the school shows the location of the buried rainwater collection tanks.

The beauty of this school is much more than just aesthetic. The school is truly a living science lab. Not only do the neighborhood students benefit from the innovative building, students from all over the district visit for a one-of-a-kind, hands-on learning experience. There is no other place where students can experience all of these scientific concepts in action.
How the Building Fits into the Community
Lady Bird Johnson Middle School is located in the heart of the Irving, Texas community. The area surrounding the school is densely populated, providing easy access for the school’s students, 80% of whom bicycle, walk, or use public transportation to get to school. The site is immediately adjacent to transit stops, medical, grocery, laundry, hardware, and many other community amenities, making it an integral part of an existing urban fabric.

How the Project Motivates and Inspires
Imagine a 150,000 square foot facility that produces the energy it uses. This school serves as a model of what is possible. The information and data collected from the facility is being shared to help students, teachers, and community members understand the benefits of sustainable systems.

Lady Bird Johnson Middle School is the first net zero energy public school in Texas. As such, the district and design team have used this opportunity to start a dialogue and educate the community on a statewide and nationwide basis.

Students enter Lady Bird Johnson Middle School and are taught the systems and benefits to the economy and environment. Projects and assignments in various curriculum areas use the system data to further engage students in their learning environment.

One particular incident that occurred shortly after opening day involved the kitchen pulper. The pulper is used to process the recycled content trays and plant-based utensils back into a recycled pulp. The system experienced a glitch that put the device out of commission for a couple of days. The students were already so invested in the concept of recycling and tracking their carbon footprint that they informed the principal they would need to adjust their calculations for the month.

On another occasion, a student sent the principal an email asking questions about the LEED submission he had been studying and offered suggestions for additional points to prove the design team feedback on their work.

Students at Lady Bird Johnson Middle School are given the opportunity, information, and support to become stewards of the environment and to understand how their actions affect their community.

Sustainable Systems Incorporated and Goals and Outcomes
Lady Bird Johnson Middle School is designed to produce as much energy as it consumes over the course of a year. The design team worked closely to calculate building energy needs and balance it with the on-site energy generated. The strategies and systems included to achieve the net zero energy goal include:

Land Use & Site Ecology:
The design of the project utilized many of the guidelines of the Integrated Storm Water Management in the site planning and design. Storm water management was our major objective and was accomplished by utilizing the following:

Water Quality – The storm water runoff from the parking lot areas is diverted to bio-swales and grass filter strips to help with sediment removal. The treatment of the storm water runoff was further aided with the addition of filters that were added inside the storm sewer inlets. The surface runoff is collected into an underground storm sewer system which was then discharged into a concrete lined channel to help reduce surface erosion.

Rainwater Harvesting – Rainwater from the roof drainage system is directed to an underground tank for reuse as irrigation to adjacent landscape areas.

Construction Methods – During construction, the contractor was required to conform to the Storm Water Pollution Prevention Plan that helped reduce the pollutants from the site and provide containment for hazardous materials. The contractor was also required to monitor and provide dust control to reduce airborne contamination. Disturbed areas were covered by vegetation as soon as possible to limit the exposure of unprotected ground surfaces.
Physical Environment
Physical Environment

Building Orientation and Design:
A primary hot and humid climate provided an interesting study for the building design, which was complicated by a confined narrow site that stretched in a north/south orientation. The building design response was to create a compact footprint with two-story classrooms facing a westerly direction. The western portion of the site was the only side offering open views. Solar shading became important along the classroom side to allow natural light but provide the necessary shading for the windows. Models and shading studies determined the optimum solutions to provide shading on the windows throughout the end of the school day. Windows on the corridor side of these classrooms allow the borrowed light from the exterior windows to reduce the amount of artificial lighting required in the LED lit corridor spaces. Large north facing clerestory saw tooth down the large central corridor to provide natural light and eliminate the need for artificial lighting during school hours.

Daylighting:
Research has shown that natural lighting in the educational environment improves student achievement. Day-lighting plays an important role in school facility design. Lady Bird Johnson Middle School allows an abundance of natural light into all teaching spaces. The main classrooms are housed in a two-story classroom wing that provides large windows into all rooms. The science labs are located on an internal corridor where borrowed light from the north facing clerestory light the central corridor. The library space is enclosed in glass on two sides that allows natural lighting throughout. Gymnasium spaces have large north facing windows. The natural light levels in the building greatly influence safety and security in the event of power loss. All areas have adequate levels of light during the day without artificial lighting.

Window shading is provided for openings along the west side of the building through stepping the elevation of the building and incorporating shading canopies. Light shelves are used at openings along the south side of the building and large, north facing clerestories are incorporated into the central main corridor to bring natural light into the middle of the compact building plan.

Water Conservation:
The school is located on a narrow site adjoining a drainage canal and a 100-year floodplain. Rain water collected on the roof runs to an underground system. Mechanical condensate, hand washing lavatories, showers, and clothes washing machine drains are collected in the Gray-water waste system, which drains into the sub-surface cisterns to be used for drip irrigation in planting areas around the building. This collection of water coupled with the high efficiency plumbing fixtures creates a considerable reduction in water use. These fixtures combine to make it possible to achieve the WEp1, Water Use Reduction of 41%.

Geothermal Energy:
Geothermal technologies are used for the heating, ventilating, and air-conditioning for the middle school. This sustainable technology is the largest contributor to the building’s energy consumption and is conservatively estimated to reduce the building energy load by 30% over a standard HVAC system. The geothermal system uses individual water source heat pumps and on-demand pumping, coupled with a vertical bore heat exchanger. The heat exchanger consists of 400 vertical geothermal wells arranged in well fields. Each well is approximately 6 inches in diameter and 250 feet deep. The closed loop piping uses the constant temperature of the earth to moderate the temperature of the water used for the heat pumps, eliminating the need for the chiller and boilers and providing the highest efficiency for conditioned space in a warm climate. The cost analysis for the geothermal was based on the historical data of the design team experience on over 40 area geothermal schools.

The geothermal strategies were integral in the payback analysis for the net zero facility. The payback analysis for the solar was done both independent of the geothermal and in conjunction with the geothermal. When the two sustainable systems were combined, the payback for the net zero energy investment was around 12 years.

Wind Power:
On site production is supported by twelve small commercial 2.4kw wind turbines that produce a small percentage of the overall energy, but serve as a sustainable marker for the school and a learning tool for students.

The light commercial wind turbines were conservatively estimated to provide 1% of the total building energy production. The district felt it was important to include wind energy in the building for educational purposes due to the large amount of wind energy produced in Texas.
Physical Environment

**Solar Power:**
A cool roof was installed, decreasing the heat gain and increasing the efficiency of the solar panels housed on the roof. The production of energy onsite is also accomplished with a 600KW solar array located on the building roof. The 3,000 solar panels produce over 800,000kw hours annually. The cylindrical tube system is installed on a white (cool)roof and is designed to use direct sunlight as well as reflected light to maximize the amount of power that can be produced per square foot of roof area. The cylindrical tubes in the panel capture sunlight from 360 degrees. Efficiencies are increased since direct, diffused and reflected sunlight contribute to the energy production. Maximizing roof area was imperative for optimizing the allowable square footage for installation of photo voltaic panels.
Physical Environment

Lighting:
Classroom and Library fixtures located adjacent to exterior windows have daylight sensors and integrated dimming ballast and a ceiling mounted light sensor to automatically reduce output from the energy efficient fluorescent lighting, with no occupant input and no visible reduction in illumination. LED lighting is used in the classroom wing corridors and student restrooms. All exterior lighting including the parking areas utilizes LED fixtures. The building main corridor, cafeteria, classroom, and gymnasium have abundant natural light and only need artificial lighting during inclement weather or during non-daylight hours. A holistic monitoring system provides lighting control and daylight sensors, plug load metering and controls.
Physical Environment

Building Automation and Monitoring System:
The building has a Central Energy Use and Monitoring system capable of displaying current weather at the site. The system illustrates energy being used by the facility as a whole, and broken down by load type. All HVAC loads are separately metered at each HVAC panel. All classroom lighting and general purpose electrical outlets in the building are electronically metered at a “per classroom” level. The system displays how much electricity is currently being produced by the solar array and wind turbines. All of this information is shared within the web based system, and will be collaboratively used by the faculty to show students how the on-site renewable energy systems are off-setting the current building energy needs.

Materials and Construction:
Lady Bird Johnson Middle School is designed for long life and low maintenance. The building exterior is clad mainly with locally manufactured brick. Exterior concrete columns are exposed and provide durable finish without the need for high VOC coatings. The site and building use concrete with fly ash and structural steel with recycled content. The interior carpeting is made from recycled content and rubber flooring that has low life cycle costs and eliminates waxing and the use of chemicals for periodic maintenance. Recycled glass countertops are used in the serving and preparation areas of the kitchen. Low VOC paints were used throughout the building. The kitchen’s recycled content fiberboard trays and plant based wares are disposed in a pulper system that eliminates the old dishwashing systems and plastic trays. The pulper system dramatically reduces the amount of water and chemicals used and reduces the waste footprint of the building. Recycle centers are located throughout the building. Networked printers are centrally located to replace the district standard of a printer per classroom and support the campus goal of a paperless environment. All of the building furniture selected is green guard labeled to further support the sustainable vision.
5.0 RESULTS OF PROCESS AND PROJECT

Describe How Project Achieves Educational Goals

The District’s goals for this facility did not stop with a net zero challenge. The Board of Trustees insisted the facility be designed as a learning tool not only for the students that attend Lady Bird, but for all of the 34,000 district students at all grade levels. The Board wanted their students to experience and learn from the sustainable features incorporated into the facility.

To meet this educational goal, the architects worked closely with the science department to incorporate the building’s sustainable systems into the science curriculum. Interactive learning nodes for geothermal, wind, solar, and water conservation are located in the main hallways and provide hands-on learning for students.

Lady Bird Johnson Middle School successfully integrates Irving Independent School District’s goal of capping student enrollment at middle school campuses with their initiative of being pioneers in the field of teaching/learning and being stewards of the environment.

Touch screens located near the main entry lobby give a quick snapshot of the building’s energy efficient technologies and sustainable features. The energy monitoring display serves as a teaching tool to visitors and users alike, while creating benchmarks for energy consumption and generation. The building users are engaged and reminded that the net zero aspect of any building ultimately depends on the end user.

A holistic monitoring system provides on-site and web based real time information of each system and the building use as a whole. This monitoring system enables students to access information such as how much energy the solar grid is producing on a cloudy day or how much power is being used in each classroom. The system makes it possible for a student to plug in a space heater in a classroom, then access a plan of the school where the room would flash red, indicating that the room was using more power than allowed by design.
Lady Bird Johnson Middle School is designed to include green building technologies into the educational environment. A monitor display located in the main corridor at the entry shows all the data for the system, including energy being used and energy being produced at any given time. A geothermal corridor exposes the system, components and laptop charging stations provided that are charged by solar energy. This “solar corridor” incorporates the power requirements with educational needs.

To accommodate students throughout the district visiting this facility, a large learning science flexible lab is located near the front entry adjacent to the library area. This room accommodates a bus load at a time in an interactive lab where students gather and learn prior to moving throughout the building. In this learning lab, geothermal ports are located within a cabinet for access within the room. The main corridor in the facility that runs north south has incorporated “learning nodes” for each on the main sustainable technologies: solar, geothermal, wind and water conservation. Each of these nodes provides graphic display areas, four 60” digital monitors that show the real time information from the monitoring systems, education video, wind maps, earth temperatures and more. Central to each node is a three dimensional interactive display that explains how the natural resources work, how the sustainable systems work, and how they are used in the school. These areas provide students with a museum quality interactive display that shows how each sustainable technology works through hands-on activity. For example, the wind node has a scale model of a wind turbine with a city around it. The turbine can be activated by a hand crank that students use to turn on the city’s lights. The faster the turbine turns, the more lights appear. In other areas of the building, the main inverter room has a wall of glass so students can see the equipment and gauges at work during the normal school day. Access for students to the solar array has been provided with a large platform on the roof.

A sun dial is incorporated into the project as a design feature and a teaching tool. The sun dial plaza is designed as a perfect outdoor classroom.

How Project Achieves District Goals

In designing a sustainable building it is important to set goals early and work as a team through the design decisions. In the case of a public school, tax dollars are being spent and the school district is accountable for the decisions relating to those dollars. It was important to provide the decision makers with life cycle costing and payback evaluations on every aspect of the building systems so they might better inform the public on the efficiencies and sustainability of the new building.

Balancing the requirements of the sustainable building without losing sight of the district’s needs for a typical middle school involved intensive collaboration between the architect, engineers, owner and construction manager. An independent energy model agency was incorporated to work closely with the team to identify building design improvements.

Energy was the focus of this project, but conservation became an important principle. Water conservation was a message the district wanted to embrace through the use of efficient low water plumbing fixtures, and a water harvesting system that collects rain water, grey water, and condensate to use for ground irrigation around the building. Conservation of resources was also considered for paper. Printers were removed from classrooms and relocated to centralized networks. A paperless campus goal helps reduce the amount of paper used. Recycling centers throughout the facility are strategically located near printer and multi-use spaces.

The beauty of Lady Bird Johnson Middle School is much more than just aesthetics. This school is truly a living science lab. Not only do the neighborhood students benefit from this innovative building, students from all over the district come for a one-of-a-kind, hands-on learning experience. There is no other location where students can walk around and see all these science concepts in action. We are finally able to empower students to be innovative thinkers in their global communities.
Results of Process and Project
Results of Process and Project

How Project Achieves Community Goals
This building is designed as a teaching tool and resource for the Irving Independent School District and has been integrated into the science curriculum. Touch screens, holistic energy monitoring live display, display areas at the nodes, solar array observation deck, Omni room (the learning lab), and the observation window into the inverter room are some of the features incorporated into the building.

Using renewable sources of energy reduces our country’s dependence on foreign oil and conserves dwindling resources. A net zero middle school sends an environmentally conscious message not only to the students that use the building but to the community, the city, and the country.

Conclusion
Buildings consume approximately 40% of the energy produced and use 30% of raw materials to build. Lady Bird Johnson Middle School is the first net zero building in the State of Texas and the largest net zero public school in the country.

Building net zero is the right thing to do for future generations, to conserve natural resources and to minimize environmental impact. Improving building efficiencies and use of renewable resources reduces maintenance and life cycle costs for the school district. It is also the most effective use of public bond dollars, and a way to encourage students to become stewards of the environment.
6.0 ADDITIONAL IMAGES
Executive Summary

This document is an architectural program and list of educational facilities specifications for the design of a new middle school.

This school is designed to house approximately 900-1,000 students in grades 6th through 8th grade, including special needs students.

All of the requirements included herein can be categorized as one of the following types:

- General considerations that will guide the Architect in setting the overall design concepts of the school
- Space requirements that describe the number of spaces and their size requirements (minimum square footage)

The design of the school must provide an aesthetically pleasing atmosphere conducive to the learning process. The design should eliminate obstacles and distractions to the learning process. The distribution of spaces should enhance the many functions which take place within the facility.

The building should promote a feeling of “belonging” for the people who use or come in contact with it. The students and school staff should feel comfortable using it and the public should have no reservations about visiting the school.

The facility must be durable and require minimum maintenance. Materials, products, and methods of construction should be selected based for achieving the best possible performance over time within the constraints of the budgets.

Finally, the building is to be designed to function as a net zero energy building and should provide educational opportunities within the facility to reinforce the sustainability of the building and commitment to the environment.
Section I - Facility Standards

Instructional programs, grade configurations, and type of facility:

- Programs include general instruction and specialized instruction Grade levels 6th through 8th grades.
- The facility will be a middle school and will include fine arts educational spaces including band, choir, orchestra, visual arts, and theater arts. Athletic spaces will include a competition gymnasium, practice gymnasium, track and field, weight room, athletic and physical education locker rooms for boys and girls, coach offices, laundry, and storage.

Building Capacity

The maximum building capacity, or maximum occupant load, in a building is determined by code required occupancy each occupied space. This occupant load amount would be met if all spaces were used to their maximum capacity simultaneously. This occupant load amount is used for fire egress requirements and plumbing fixture counts, and usually is not the amount of students actually at the school.

The functional building capacity, or functional student load, in a building can be determined by taking the Texas Education Agency (TEA) requirements and multiplying the number of classrooms provided. This student load amount is used as the design occupancy of the school.

TEA Minimum Square Foot Requirements per Student:

- General Classrooms = 28 SF per student or minimum of 700 SF (25 students)
- Specialized Classrooms
  - Computer Classroom = 36 SF per student or minimum of 900 SF (25 stations)
  - Science Lab/Classroom = 1200 SF (24 students)
  - Special Education Classroom = 40 SF per student or minimum of 400 SF
- Gymnasium = 4,800SF Minimum.
- Library = 3,000 ASF plus 3 SF for each student over 500 = 4,500 SF minimum.

Estimated size of facility:

- The estimated size of the new elementary school is 150,000 Gross SF. Reference Section III List of Required Spaces for a comprehensive listing all classrooms and spaces to be provided in the master plan.

Estimated budget for the facility project:

- The construction budget estimated for the new elementary school is $29,000,000.

Hours of operation that include instructional day, extracurricular activities, and any public access or use:

- Instructional hours for students will be 7:30am – 3:30pm; extracurricular activities may take place before and after instructional school hours.
- Public use of middle school buildings and facilities will be in accordance with Board of Trustee policy and administrative operating guidelines.
- The facility will be equipped with the following:
  1. Fire Alarm system with visual and audible alarms as required by code
  2. Sprinkler system
  3. Security system
  4. Phones in every classroom
  5. Access control system
  6. Integrated intercom system with programmable music system
Section II - Programming Concepts

Population and Scheduling
The current policy is for the school hours to be from 7:30 a.m. to 3:30 p.m. Monday through Friday. The building will, however, be used for longer hours. Such events may include breakfast programs, athletic games, theatrical productions and for community activities, occurring before and after hours.

The classroom sizes meet or exceed the space requirements per the Texas Education Agency.

General Building Criteria
It is the desire of Irving Independent School District that every building reflect its vision and goals. The District wanted an architect to provide buildings that people will point to with pride; buildings that will upgrade the surrounding area, and that will become the center of neighborhood activity.

- The facility should be a student focused environment.
- The facility should provide flexible spaces.
- Most of the classrooms should have natural light and a view of the outdoors.
- To the fullest extent possible, design the facility to reduce operating and maintenance costs.
- All areas of the facility that are to be used by staff and students should be wheelchair accessible and conform to all applicable statutes and regulations and Texas Accessibility Standards (TAS) requirements.

Maintainability
The initial cost of a building is far less than the costs involved in maintaining a building over its lifetime. The decisions made during the design are based on considerations of life cycle costs or the cumulative cost of an item or building system over its life span as well as the original cost. The considerations for the efficiency of the building over the building life are considered in decisions throughout the design and construction process.
Section II - Programming Concepts

Spatial Organization and Relationships

Interior Spaces

- Anticipate that the cafeteria, gymnasium, counselor’s office, clinic, some classrooms, and a set of restrooms will be used either after or before standard school hours.
- The library may also be used for PTA and faculty meetings in the evening. The library may also be a community use facility on evenings and weekends.
- Custodial workrooms and storage should be distributed throughout the school to allow for easy cleaning, maintenance and storage of supplies.

Site Access and Circulation

Access to and from the site and into the building is critical to the design of the school. This need is magnified by the number of different types of users including: students (arriving by bicycle, on foot, by car, or by bus) teachers and staff, parents, deliveries, service, and emergency vehicles. The architect should strive to keep as much of the site open and unpaved as is feasible.

Consider the following when designing the school:

- Access onto the site should be logical and easily discernible for those who will use it.
- School bus drop-off and parent drop-off should be separated and well defined to reduce confusion and congestion.
- Parking areas should be provided for visitors, and faculty.

Building Access and Circulation

The entry should be clearly defined and have close proximity to the administration area for parents and visitors, and should incorporate an electronically controlled entrance for security.

Items for consideration:

- The cafeteria may be used for staging areas for school bus unloading/loading.
- Deliveries should be made to the service doors or kitchen.
- Circulation within the building should be logical and easily learned by students. Guideposts, color schemes or other devices should be incorporated into the design to make it easier for students to navigate around the school.

Security

The architect should think about building security at all times while designing the facility. Specifically, do not design hidden interior or exterior areas. Similarly, there should not be any place for potential intruders to hide from police or security forces on patrol. Security should be the main consideration when locating exterior lighting.
Section II - Programming
## Section III - Required Spaces

### Program Requirements

#### Lady Bird Johnson Middle School

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<tr>
<th>Irving Independent School District</th>
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<th>Total Area</th>
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### Lady Bird Johnson Middle School

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### Section III - Required Spaces

#### Lady Bird Johnson Middle School

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<th>Irving Independent School District</th>
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<th>Qty</th>
<th>Area S.F.</th>
<th>Total Area</th>
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### 8.0 CONFIDENTIAL DATA SHEET

**2012 James D. MacConnell Award**
**Project Data: Confidential Information**

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<tr>
<td><strong>Project Address</strong></td>
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<td><strong>City/State/Zip/Country</strong></td>
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<tr>
<td><strong>Superintendent/President</strong></td>
<td>Dr. Dana Bedden</td>
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**Submitting Firm:**
- **Project Role (Architect, Planner, CM, Other):** Corgan Associates, Inc.
- **Architect:** Susan Smith
- **Title:** Vice President
- **Address:** 401 N Houston
- **City, State or Province, Country:** Dallas, Texas 75202
- **Phone:** 214-748-2000
- **Email Address:** Susan.smith@corgan.com

**Joint Partner Firm:**
- **Project Role (Architect, Planner, CM, Other):**
- **Project Contact:**
- **Title:**
- **Address:**
- **City, State or Province, Country:**
- **Phone:**
- **Email Address:**

**Other Firm:**
- **Project Role (Architect, Planner, CM, Other):**
- **Project Contact:**
- **Title:**
- **Address:**
- **City, State or Province, Country:**
- **Phone:**
- **Email Address:**

### 9.0 PHOTO RELEASE FORM

**Name of Project:** LADY BIRD JOHNSON MIDDLE SCHOOL

**Location of Project:** IRVING, TEXAS

**Occupancy Date, if applicable:** AUGUST 2011

CEFPI has our permission to:
- [ ] Send photos electronically to jury members (required for entry).
- [ ] Display photos in the award winners’ area of the website, if selected as a finalist.
- [ ] Display photos on other sections of the website as representative CEFPI projects.
- [ ] Print photos in CEFPI newsletters.
- [ ] Print photos on CEFPI marketing materials, i.e. brochures, awards, call for entries, etc.
- [ ] Print photos and project details in the CEFPI Design Portfolio, if selected as a finalist.
- [ ] Special projects with prior permission.

Please Note: CEFPI maintains an in-house archive of school designs as part of our research library. Your information will be entered and recorded as one of those designs.

**Firm:** CHARLES D SMITH

**Responsible Party/Photographer:** CHARLES D SMITH

**Signature:**

**Date of Release:** 9/6/2012